



Chambers's Journal

SIXTH SERIES.

MODERN SHELLS AND PROJECTILES.



THE idea of hurling explosive or fiery missiles into the ranks of an enemy on the battlefield is one of great antiquity. So far as reliable historic data exist, the first occasion of their use in actual warfare was about 327 B.C., when Alexander the Great, while attempting to extend his conquests to India, was opposed by arrows tipped with a fiery composition. No further progress in this direction, however, seems to have been made until the eighth century, when it is recorded that rockets containing a highly combustible mixture were frequently thrown in a burning condition amongst the enemy. Prescriptions for preparing such rockets are given by Marcus Græcus, who lived about the end of the eighth century, and whose manuscripts are still preserved in the National Library at Paris. It is also recorded that rockets of this description were used by the Saracens against the Crusaders, causing great discomfiture in the ranks of the latter. Such appliances as these, crude as they undoubtedly were, furnished the germ from which the modern projectile has evolved. To trace the development of such missiles up to the present day would be a task of considerable difficulty; it is only proposed here to give a brief account of the shells and projectiles at present used by the armies and navies of the higher civilised nations.

Four chief varieties are now employed in active warfare, each being constructed to attain a special object. They may be classified as follows: (1) shrapnel, or man-killing shells; (2) shells whose object is to destroy earthworks and fortifications; (3) armour-piercing projectiles; and (4) star-shells, used to provide light when a searchlight is not available. It is proposed to give a brief description of each of these in the order given above; and it may be here stated that each variety is made to a standard size, so that all may be fired at the discretion of the officer from one and the same gun.

The shrapnel, whose object is the destruction of

human life, is one of the most deadly weapons of warfare the world has ever known. It consists of a hollow cylinder of iron having an oval-pointed end separately attached—the pointed end securing a less resistance to flight and greater steadiness. Down the centre of the shell is a small tube, open at the pointed end and communicating with a charge of powder at the base. The body of the cylinder is filled with bullets, numbering in some instances upwards of five hundred. When it is desired to fire the shrapnel, a 'time-fuse' is placed in the mouth of the inner tube immediately before loading. The time-fuse consists of a conical piece of wood bored to a certain depth, and filled with powder. A hole is bored from the exterior of the fuse to the contained charge of powder, through which the flash of the burning fuse may communicate with the powder at the base of the shell and cause it to explode. The actual firing of a shrapnel, therefore, consists of three distinct operations—namely, the ignition of the fuse, which is brought about by the burning of the cordite or powder in the gun at the moment of propulsion; the ignition of the charge at the base by the agency of the fuse; and finally, the explosion of this charge, which blows off the head of the shell and liberates the enclosed bullets, allowing them to scatter over an extremely large area. A shrapnel, in this manner, produces a result equal to that of five hundred rifle-bullets.

A simple experiment may be made to illustrate the manner in which the 'deadly hail' from a shrapnel is distributed. If a number of peas or small pebbles be confined in a paper bag, the mouth of which is insecurely closed, and the bag be projected forward mouth-foremost, it will open during flight, and the contents will be observed to escape and scatter in various directions, much in the same manner as the jets of water from a watering-can. The blowing out of the end of the shrapnel allows the contained bullets to disperse in precisely the same manner that the opening of the paper bag during flight admits the escape of the peas or pebbles.

It is obvious from the foregoing that the most advantageous place for the shell to burst would be at a short distance in front of the enemy, so as to obtain the maximum effect—a result which scientific gunnery has rendered possible at all distances within the range of the gun. By the use of the Ballistic Tables compiled by the Rev. E. Bashforth, late Professor of Mathematics at the Artillery College, Woolwich, the distance of any given projectile from the gun after the lapse of every fraction of a second may be accurately determined; and the results for each class of shell are recorded in the range-table possessed by every officer in charge. All that is necessary, therefore, is to arrange to burst the shell at a given moment after firing, which may be done by adjusting the fuse so that the flash from it shall reach the bursting charge at the desired moment. As previously described, the fuse is bored immediately before loading; and marks on the fuse indicate where it must be bored to flash at any required time. By these scientific processes it is possible to obtain results of surprising accuracy, the error not exceeding a few feet in a range of several miles. It is this precision which renders the shrapnel shell such an extremely deadly missile.

When the object is to destroy fortifications or earthworks, a shell is used which contains a large charge of powder or picric acid (sometimes called 'melinite' or 'lyddite'), and which, unlike the shrapnel, has no bullets in the interior. Further, such shells are arranged so as to explode on striking, the fuse previously described being replaced by a percussion-cap, which brings about the explosion of the charge when the shell strikes in exactly the same manner as the firing of an ordinary rifle. In outward appearance this shell resembles the shrapnel, the pointed end being hollowed out for the reception of a screw-plug containing the cap, which is inserted immediately before placing in the gun. The action in this case is comparatively simple. When the shell strikes an object, the pointed end becomes embedded to a greater or less extent owing to the tremendous velocity with which it is projected. The concussion produced by the impact of the point fires the cap, which in turn ignites the bursting charge, and the shell bursts into fragments with terrible violence. Such a shell in action is exactly equivalent to a charge of explosive placed in position for blasting purposes, and produces an equal effect; the fragments of the shell, in addition, often causing great loss of life. In the naval engagements during the recent Chino-Japanese war, cases were recorded where a single shell of this type, striking some object on the deck of a battle-ship, not only wrought great havoc amongst the appliances in the vicinity, but by the fragments produced on its bursting killed upwards of forty men. When it is known that the largest shells contain nearly two hundred

pounds of explosive material, such terribly devastating results can be readily realised.

The armour-piercing projectile differs from the two former in containing no internal charge. It is practically solid, and has a cylindrical body and pointed end. The object of this projectile is to pierce the steel armour of a vessel, and it must therefore be composed of an extremely hard and strong material to achieve this end. A special kind of steel is used in the manufacture of this class of missile, which, whilst not sufficiently hard to develop brittleness, possesses sufficient toughness to resist crumpling on impact. The point is specially hardened, so as to render it capable of penetrating the best quality of armour-plates. The destructive capacity of these projectiles is enormous, and the extent to which they will penetrate the hardest steel is truly surprising. Captain Orde Brown, R.A., has published a rule, based on actual experiments, which states that 'an armour-piercing projectile will penetrate a distance equal to its own diameter for every thousand feet of striking velocity.' Thus a shot of this kind fired from a ten-inch gun, and striking at two thousand feet per second, would penetrate twenty inches of steel; at fifteen hundred feet per second, fifteen inches; and so on. The latter velocity would easily be obtained at close range, and in the event of the projectile striking truly, the thickest armour-plate possessed by any warship afloat would be completely penetrated. The blow struck in this case would be equal to that produced by a weight of seven hundred and five tons falling a distance of ten feet. Recent improvements in hardening or 'Harveyising' the surface of armour-plates, however, have greatly diminished the efficacy of armour-piercing projectiles; and it is probable that with recently manufactured plates the actual penetration would only be one-half as much as stated in Captain Brown's rule.

The fourth class of shells used by the armed forces of this country—namely, star-shells—do not partake of the destructive character of those previously described. Their object is merely to furnish a light by means of which the movements of the enemy may be clearly discerned on a dark night, and surprises thus avoided. In their mode of action they resemble a shrapnel, and are arranged so as to burst in mid-air by the agency of a fuse and bursting charge. They contain a special composition, consisting of barium nitrate, chlorate of potash, and powdered magnesium, which is inflamed by the bursting charge and produces an intensely brilliant light—a similar composition being employed for flash-light photography. By means of these shells a very large tract of country may be illuminated, and in this manner any attempts at night attacks may be discovered. Star-shells of this kind proved extremely valuable during the recent frontier campaign in India, and contributed very

largely to the success of the various expeditions against the hostile tribes.

With such missiles as the foregoing, it is evident that warfare at the present day has far greater capabilities for destruction than at any previous period of the world's history. When we consider, likewise, that any of these

projectiles may be hurled enormous distances with great accuracy, we may well stand aghast at the possibilities of a great European war, and fervently hope that the potentialities of such deadly munitions may deter the nations from resorting to the arbitrament of an armed conflict.

THE SHIP-BREAKERS.

A FENLAND ROMANCE.

CHAPTER IV.—RUTH LEAVES CABLETHORPE.



RUTH'S was an inner room, beyond Hettie's; for Hettie, being the first to rise ever since Ruth could remember, had always been mindful of her delicate sister's repose. Ruth lay down upon her bed, in a dressing-gown, without firelight or lamp, well content to rest there and catch the sound of John's strong voice when their old servant, shuffling across the hall with plates and dishes, happened to leave the parlour door ajar.

Presently Ruth heard the shuffling feet of the servant on the stairs. She knew that the woman, having served the evening meal, was coming up to see what she could do for her.

'I need nothing, Mrs Mumby,' said Ruth, turning her face to the wall. 'It's only one of my headaches. I shall be well to-morrow.'

Mrs Mumby, who was a maiden sister of the crusted waiter at the 'Jolly Bacchus' inn, shaded her candle with her hand and leant down over Ruth's pillow. The light was full upon the old woman's wrinkled face. Ruth glanced up, and saw there a look of kindly concern for her. 'Why, Mrs Mumby, what is the matter?'

Mrs Mumby touched Ruth's hot forehead gently with her horny hand. 'Don't *you* go falling ill, miss.'

'I'm not going to fall ill. But'—

'What, then?'

'I am going away.'

'Going away?' and Mrs Mumby expressed her incredulity by breaking into a low, croaky laugh.

'Yes. You will take care of Hettie, won't you?'

'Why, bless you, *she* don't want no care-taking! But there,' said Mrs Mumby, patting Ruth upon the shoulder; 'get to bed and to sleep. Going away indeed! I've no patience with such talk.'

Ruth was not displeased to find that the old servant refused to take her threat seriously. In fact, she had too often expressed this same threat before. But this time Ruth was in dead earnest. She was sternly resolved upon flight at last.

She would go to London. But she had no thought—none at the moment—as to what she should do there. Her one thought was to escape

from this sense of uselessness and nonentity. She would put this miserable love for John Jarvis out of her heart. She would go where there would be nothing tangible or intangible to remind her of the past. She would go forth at daybreak, take the earliest train to town, and return to Cablethorpe no more. She walked about her room, thinking over her determination and trying to perfect her plans. She must write a few pencilled lines to Hettie, endeavour to justify her conduct, and crave her forgiveness. She crept into bed at last, and waited with wakeful eyes for the dawn. She heard Hettie moving about softly in the adjoining room after a while; then all was silent.

Ruth fell into a doze. But she soon started up, her heart beating fast, to look out of the window for a faint indication of daybreak. At this moment the old clock on the staircase began to strike.

'Five!'

Ruth had packed a small valise; and now she was quickly dressed, with a thick cloak over all, and ready to start. As she went noiselessly through Hettie's room she placed the letter on the bed beside her pillow and passed on. She chose the back way. The kitchen door was softly unbarred, the garden was soon reached, and as Ruth went out into the fields she caught a glimpse of light in the eastern sky over the dunes to seaward. Turning presently into a narrow lane, she reached the High Street. How strangely loud, how full of echoes, her footstep sounded as she hurried through this old town of Cablethorpe in the dawning light!

There was nearly an hour to spare when Ruth reached Cablethorpe Station. She sat down in the waiting-room—where a porter was making desperate efforts to kindle a fire—and tried to keep her excited thoughts under control. She was overwhelmed with consternation at the step she had taken. Something might occur at any moment to defeat her project. Every sound startled her; every passing step on the platform outside filled her with a dread that Hettie had discovered her flight. The train came lumbering into the station at last. She took her place, drew the curtain across the window, and sat in breath-

less expectation until Cablethorpe was left far behind. She was alone in the carriage. She put down the window now, and let in the wind upon her flushed cheeks. There was a delicious keenness in the air, and presently the sun came blazing up out of the east, spreading a wintry warmth and glory over the fenlands. She had started on her first long journey alone. London was unknown to Ruth. It was a place about which she had read strange things—about which she had conjured up a hundred visions. It existed in her imagination as a vast city of marvellous contrasts, a city that could not be surpassed for its wealth or indigence, its piety or crime. Until to-day—until she found herself hurrying towards this great centre—she had never fully realised, though it had often crossed her thoughts, that the day might come when it would be her destiny to be whirled into London, and alone.

It was long past midday when London was reached. Ruth deposited her valise in the left-luggage office, and then went and sat down in the refreshment-room at King's Cross Station to try and think what should be done next. Where should she find a lodging? The thought did not greatly disconcert her. Even a delicate woman with a spirit of independence cannot long dwell on the gloomy side of life. She was a fair pianist, and would be able to pay her way by teaching music. Three or four pounds, it is true, was the extent of her capital. But how many a woman had made an independent start in life with less—without as many shillings! Meanwhile Ruth was getting hungry. She ordered some dinner—for an obsequious waiter was hovering round her chair—and realised that the start in life had been made.

An hour went by. Then she hastened out of King's Cross Station, bent on looking for a room, and walked quickly through the streets. She presently found herself in the chilly, gloomy district of Pentonville. She wandered from street to street. She was growing weary. She looked in at parlour windows as she went along, where there was frequently a fire burning brightly, where lamps were being lighted, where merry faces peered out while the curtains were being drawn; and sometimes the laughter of children would reach her ear. Tears came into her eyes. She thought of John, of her sister Hettie, of the home from which she had so impulsively turned away. She understood for the first time what such glimpses of fireside life must be to the out-cast and homeless. And now she began to get afraid of herself. Dread looked out through her tearful eyes; she was alone in London; and the night had closed in at last.

Tudway had joined his ship. Mrs Clitherow had packed his box and prepared his breakfast, and had listened in a motherly way to all his talk about Hettie Beek. She had known him

ever since he was a boy; for he had always spent his holidays with his uncle in Nelson Square, where he had nearly driven the landlady crazy with his mad pranks and practical joking.

Upon a certain wintry afternoon, having carried up the captain's dinner, it chanced that Mrs Clitherow stood at her front parlour window looking out upon the round garden in the old square. She was a little, chubby-faced woman, with black hair and dark, good-natured eyes. There was frequently a wistful look in them. This expression may have been caused by a natural anxiety for lodgers. The inquiries about her drawing-room floor were very few and far between. There were lodgings to let in nearly every house in Nelson Square; and it never seemed to occur to any one to turn out of Southwark Road, when hunting for 'apartments,' and take up their abode here in peace and quietness.

The square was a quiet, peaceful place, even of an afternoon. There was only one street out of it. This led to the broad highway. There was a little one-bar gate in a back corner, by which it was supposed you could also get into the great thoroughfare; though even Mrs Clitherow, who had lived in Nelson Square nearly twenty years, had never ventured to attempt an exit in that direction. While the landlady was still standing at the window, with no light except a flickering street lamp to enliven her, a four-wheeled cab rattled into the square. The little woman's interest was instantly roused. It was such an unusual occurrence. But when the cab presently drew up at her house and the cabman jumped down to open his cab door, her curiosity knew no bounds. She was beginning to wonder whether a guinea a week for her drawing-room floor would be considered exorbitant, when who should alight and come up the steps but Ruth Beek! Before the girl had time to knock or ring the landlady appeared and welcomed her with kisses on both cheeks.

'Why, Miss Ruth,' said Mrs Clitherow, 'whatever's brought you to town—and all alone too? Dear, dear!'

Never waiting, never seeming to expect any answer, Mrs Clitherow began to help Ruth off with her cloak and bonnet, and then she knelt down to put a match to her parlour fire.

Ruth sank into a chair and sat watching the landlady with a troubled face. 'I have come to town because—because'—She gave way now, sobbing bitterly.

'There, there! Never mind, my dear, what's brought you. I'm sure I am pleased enough to see you. There! Wait till I've got you some tea,' said the landlady, becoming brisk, 'and then you shall tell me all about it.'

The fire was soon burning brightly in the little front parlour; and Ruth felt grateful for the warmth and glow—grateful for her escape out of the crowded thoroughfares. She lay back wearily in her seat and closed her eyes. Nelson Square

seemed to her a delightful haven. The roar of traffic in the Southwark Road fell upon her ear like the noise of a distant sea. She listened in drowsy abandonment to the turmoil, recalling to mind her flight at daybreak through the High Street of Cablethorpe, her journey to London, her wanderings in the neighbourhood of Pentonville. It

was while still peregrinating there, indeed, undecided where to choose a lodging, that she had determined to seek shelter at Mrs Clitherow's, at least for one night. On the morrow, when she had rested, she would even break that link which connected her indirectly with the home at Cablethorpe.

(To be continued.)

NEW TREATMENT OF LOCKJAW.

By Mrs PERCY FRANKLAND.



HE science of immunity—the study of toxins and antitoxins, or, in more homely language, poisons and their antidotes, as we may respectively designate that great field of

research which has for its ambitious aim the banishment of disease from our midst—has already attracted investigators of the most diverse nationalities into its seductive provinces, amongst whom many have reaped a rich harvest of discoveries and left a golden record of results graven in its roll of fame. Just ten years have elapsed since the malignant microbe of lockjaw, or tetanus, was first successfully separated from its harmless associates by a young Japanese student investigating bacterial processes in Dr Koch's laboratory in Berlin. Kitasato's discovery was of immense importance, for it opened the avenue not only to a better understanding of the nature of this terrible disease of lockjaw, but also to the study of the most efficacious means for arresting its fatal course in those unfortunate individuals who had fallen victims to its machinations.

As more and more progress was made in the production of antitoxins, a substance probably chiefly associated by the general public at the present time with the new cure for diphtheria, as our knowledge concerning the methods of elaborating these potent destroyers has advanced, science has become possessed of a number of antitoxins of different kinds which can be handled and applied with almost as much ease and simplicity as the most common of our household drugs or family remedies. Statistics have shown of what service some of these so-called new cures have proved; and we have records of successes achieved hailing from all parts of the world—in the prevention of cholera, plague, yellow fever, diphtheria, as well as in compassing the lethal action of the venom of serpents. Lockjaw has, however, proved a very troublesome subject to master, and whilst encouraging results have been from time to time received of the efficacy of its antitoxin, there have also been many disappointing instances recorded in which its use has not been attended with any success. These antitoxins, it will be remembered, are simply the blood of animals which have been artificially rendered incapable of having, or immune to, any particular disease, such blood being

designated, according to its origin, 'anti-diphtheria,' 'anti-tetanus,' 'anti-plague' serum.

So far the application of these various antitoxins has consisted in simply injecting some under the skin of the individual it is intended to relieve; but a short time ago some investigations were published which bid fair to reveal an entirely new aspect of the whole study of the preventive treatment of disease. For these extremely important researches we are indebted to Dr Roux of the Paris Pasteur Institute, and his discovery will undoubtedly mark a new era in the history of preventive medicine. The distressing symptoms of tetanus all point to its being a disease affecting the nervous system of its victim. Now, the failure in so many instances of the antitoxin to mitigate in any way the progress of the disease shows that either it was incapable of arresting the passage of the virus to the nerves, or that the antitoxin never itself reached these centres. 'Let us try if we can attack the seat of the disease direct, and place the antitoxin where the activity of the toxin is greatest,' exclaims Dr Roux, and with characteristic scientific enthusiasm, he at once proceeds to put this bold idea into execution, and we shall see presently with what results. But in order to dispel any erroneous impression which may arise as to the nature of these experiments, which involve the introduction of material direct into the brain of an animal, he tells us expressly that when a harmless substance is used, or an antitoxin in such an operation, the animal suffers absolutely no ill results whatever, and experiences no sort of subsequent pain or inconvenience.

The results of Dr Roux's cerebral inoculations are of the most remarkable character. In the first place, he has discovered that the brain substance or nervous tissue of an animal possesses a special affinity for this tetanus poison—that the latter is attracted as if by a magnet to these centres of the body. Secondly, a very small quantity, quite harmless under ordinary circumstances, introduced direct into the brain infallibly destroys an animal with tetanus symptoms. This affinity of the nerve-cells of the body for poisons has been brought out in the case of other poisons also. For example, rats are proof against diphtheria, and will survive a dose sufficient to kill

several rabbits; but if some of the virus be introduced direct into their brains instead of under their skin these animals succumb to this poison. The same has been shown in the case of rabbits and morphia. These animals can stand a large subcutaneous dose of this substance, but an extremely minute quantity put into their brain kills them. This shows that rats as regards diphtheria poison, and rabbits in the case of morphia, are able, under ordinary circumstances, to withstand these substances. What may be the constitution and character of this extremely well-organised system of defence undoubtedly possessed by these animals is as yet a problem, and one which is daily exercising the speculative ingenuity of the highest scientific authorities. We have seen, however, that by placing the toxin in a different position, its lethal action may be immensely augmented; now we shall see what results follow the different placing of the antitoxin, and Dr Roux's next endeavour was to find out the action of the tetanus antitoxin as regards the lethal relationship which exists between the tetanus toxin and the nerve-centres.

Here we come to his most astonishing discovery. The tetanus antitoxin, or anti-tetanus serum, when put directly into the brain possesses the power of

breaking off or entirely annulling the fatal association of the tetanus toxin with the nervous system. A single drop of anti-tetanus blood added to a dose of the poison sufficient, under ordinary conditions, to destroy an animal, entirely checkmates the lethal action of the toxin, and the latter may be introduced with impunity into the brain of an animal. Still more striking are the experiments which show that a few drops of blood introduced into the brain of an animal infected with tetanus will arrest the progress of the disease and save the animal's life, although a very much larger quantity of the same blood introduced in the ordinary way under the skin fails entirely to prevent an animal from falling a victim to tetanus. What a vista is here opened up of what medical science may in the future accomplish! It is not sufficient to localise the disease; we must also localise the remedy. Who can say what the application of this great discovery may achieve in the case of epilepsy for example? Again, Dr Roux's researches have enlarged the active sphere of poisons and vastly extended their horizon, and to correctly define a substance as a poison now, more than ever, demands the subtlest skill and the highest scientific attainments.

A BRIDEGROOM ENTRAPPED.

CHAPTER II.

IF I had not succeeded in finding the door with the help of a light, I was not likely to do so in pitch darkness. Dawn is happily an early matter in the end of spring, and till dawn should begin I had to wait. Indeed, some measure of rest had become needful; for, between hard work, distress of mind, and starvation, I was pretty well done for.

The thought of a bell occurred suddenly; and why it had not occurred earlier I am unable to imagine. To ring and rouse the household would surely be an easy matter. In the darkness I felt about for a bell-handle or bell-rope or electric button—though, as the lamp burnt oil, the bell was not likely to be electric—and once more my efforts were crowned with failure. No handle or rope or button came to hand. I was still hopelessly immured.

Tired though I was, sleep proved to be out of the question. I do not think I kept my eyes closed for sixty consecutive seconds. If I tried to do so, an image would at once arise of Laura weeping in church for her absent bridegroom. A hundred times I writhed under the misery of that imagination. A hundred times I clenched my fist over the folly of which I had been guilty. What mattered Saxons, historical difficulties, manuscripts finished or unfinished, compared with her peace of mind? Why had I come

at all, under such circumstances? or why, if I did come, had I not had the common-sense to learn my way out of a room as well as into it?

But the angry asking of these questions made not the smallest alteration in my position? I remained a prisoner; and time was passing fast.

With the earliest gleam of dawn I was astir. The windows first claimed attention. I pushed beneath one of them the library steps, and climbed up, intending to look out; but the ground-glass defied my efforts. In vain I struggled to get the window open. An upper pane alone seemed to be movable, managed by a cord, like a church window. To get high enough for a peep out was not possible. Window number two I tried, with the same result. In a lower pane of window number three, however, I found one large spot of unground glass through which I could see. Alas! to no purpose. The height was far greater than I had expected. An acrobat alone could have made his way down with the aid of a rope, and I had no rope; neither was there aught of the acrobat in me. I had never been particularly good at athletics, and a glimpse of the rough-paved court below showed what a climber might expect if he fell.

Later on, no doubt, people would be in that court, and I might communicate with them, if only through smashing a pane of the Dean's glass; but at present the household appeared to

be wrapped in profound slumber—so much of the household as remained in the house. 'Two old servants,' the Dean had said, would be left in charge; but two alone could hardly keep this great place in order. They might be left in charge, but surely younger servants would remain also. At all events, they would not have departed in a body within an hour after the Dean had taken himself off. Even if only two were in the house—a most unlikely thing—those two would in time get up; and sooner or later one of them would come to the library, if but to dust and put it straight, and with no thought of the unhappy would-be bridegroom immured within. But how late they might choose to lie in bed, having no especial reason for getting up early, who could venture to say? That they would appear soon enough to release me for the five o'clock train was not to be hoped for.

Again I set to work, stamping, pushing, pulling, growing frantic under failure. Those grim book-cases seemed to frown upon me with a vicious derision, as if they understood and would not let their prisoner go. Not a shelf cracked; not a board yielded. Now and then, by way of variety, I tried shouting for help, banging the walls—or rather, the books upon the walls—and yelling 'Fire! Fire!' in hope that somebody might come to my rescue. Dead silence was the sole response. The servants plainly slept out of hearing.

Despair again crept over me. Three o'clock was long gone by; and four o'clock arrived. One hour only—half-an-hour—if I wished to reach the station in good time. I redoubled my exertions; and still the walls of books in solemn unbroken rows shut me in.

At last, without seeking for it, having repeatedly sought in vain, I stumbled upon a bell in a queer, unlikely corner, hidden behind a curtain. I pulled it vehemently, savagely, again and again, the wire each time yielding with a feeble creak, as if out of order. Nobody responded.

Five o'clock struck. Too late! I could not be in time for our wedding.

I flung myself down on a sofa and gave way to weariness. Nothing more could be done. I *had* to wait. My best exertions now could only enable me to send a telegram; and by-and-by might do for that. I resolved to lie patiently till somebody should appear.

But time passed, and patience again failed. No sound broke the stillness; no voice or footfall could be heard. The Dean had boasted pleasantly of his quiet study; and the silence gripped my nerves. I would have given anything for a murmur of human life. Once for ten minutes I dropped into an uneasy sleep; and immediately I was in church, waiting for my bride. When at last she appeared she was not Laura, and I woke with a start, in a cold perspiration from head to foot. 'No more sleep for me!' I said aloud, and I walked the room with restless steps.

Six o'clock struck. Seven o'clock struck. Eight o'clock struck. How much longer was this to go on? The silence had grown awful, and I was ravenously hungry.

A fit of fierce resolution seized me. I went up the library steps, poker in hand—looking no doubt like an escaped lunatic—and smashed a big pane of glass. The broken pieces fell clattering upon the stones below; but nobody called out or showed surprise. I called, shouted, yelled for help, but no voice answered. Could it be that the whole downstairs household had eloped, the two old domestics included, and that I should be left to die a slow death from starvation?

Leaning far out, I saw, to my delight, a black retriever, chained to a kennel. That meant some one coming sooner or later. The dog, at least, would not be left to die for want of food. I shouted again, and he wagged his tail, which was the thing I least wanted. If I could rouse him to bark furiously it might draw attention. I fetched bits of coal and flung them at him, and he wagged his tail anew, as if I were inciting him to a game of play. He seemed almost as forlorn as I was myself, poor fellow!

Nine o'clock struck. Ten o'clock struck.

I fell into a fresh agony of impatience. Unless I could get a telegram off in less than an hour it might not arrive in time to stop Laura from going to church in her bridal dress. A bride and no bridegroom! The thought was too ghastly. I sat down, hid my face, and groaned. Then I walked the room anew, in a fever of excitement, feeling almost as if I should go out of my mind. Those wretched Saxons!—that miserable book!—to have brought me to such a pass as this! Would Laura ever forgive me?

Once more I climbed the steps, looked out of the broken pane, and shouted at the pitch of my voice; and again I ransacked the walls in an absurd hunt for a door which all the while lay close to hand. By this time I was reckless; and the Dean's hair would have stood on end had he seen how I dragged out his cherished books by the dozen, and flung them to the ground.

For a time I think I was slightly delirious. The entrapment was so perfect, yet so ludicrous. The thought of my poor Laura drove me wild; and both hunger and thirst had me in their grasp with a clutch which grew worse hour by hour. Better to have put off the publication of my book for ten years than to have risked this misery. Other Saxon histories existed, but no other husband for my Laura. What *would* she do?

Eleven o'clock struck!

I watched the clock-hands with a dazed stare. They went at a startling pace; even the slow hour-hand seemed to trot, and the other positively raced. I could picture to myself all that was going on two hundred miles away. I could see Laura's first disappointment on learning that I had failed to arrive by the earlier train, and I

could hear her laughing yet half-pained comments on my absent-mindedness and devotion to books. I could imagine the dressing for the ceremony; the driving off; the fears expressed of a late train; the uncomfortable waiting of everybody in church; the pale and troubled face of the dear little bride on finding that I was not there; the condoling and lugubrious looks of friends. Then, as minute followed minute, I heard the cruel whispered surmises, in which some were sure to indulge, as to the true reason for my absence. Soon a messenger would walk in who had been sent to meet the train, and would say that I had not returned at all. And Laura would—no, I did not think she would faint. Girls in these days do not drop off into unconsciousness so readily as their grandmothers did; but she might suffer all the more acutely for not fainting.

Twelve o'clock struck!

It was over now. No wedding could take place. Laura's father would give her his arm, in his manner of old-fashioned courtesy, and would conduct her out of church, boiling over with wrath, though perhaps not saying very much. 'The man's a villain!' That would be his one remark. And Laura—would Laura trust me? or would she too suspect me of having played her false? I could not be sure. I could only picture how, if she did make some little effort to defend me, her brother would draw in his breath, muttering between clenched teeth, 'Don't speak of him!—the brute!'

It was all at an end now; and my Laura sat at home a forsaken bride. How should she ever dream of the real explanation?

One o'clock struck, and no one came. Two o'clock; and still I was alone. I had searched anew, shouted afresh, pulled the bell-handle again and again, all to no purpose. My brain swam, and I began to wonder—Was this a dead world into which I had wandered? I was growing faint for want of food, and my face looked ghastly, as seen in a small mirror over the mantelpiece and under the oil-painting of the old gentleman. The eyes of the latter haunted me dimly.

How the afternoon passed I cannot tell. It crept by somehow. I had fallen into a mood of dull endurance, having resolved to make little further effort until towards evening. It was evident that the domestics left in charge had taken themselves off for the day. Now and then the dog howled, as if he too felt lonely. I felt sure that I should hear his pleased bark the moment any one entered the yard.

Two, three, four, five o'clock passed in succession.

Would nobody ever appear?

I thought I would write a letter to Laura, which should explain all, in case—well, in case I never got out, but remained in durance vile till I died of slow starvation. All things considered, such a consummation seemed hardly probable—at least it hardly seems so to me now;

but I had reached a stage of unlimited pessimism. So I made my way to the Dean's study-chair, which stood close to his heavy writing-table, and placed myself where he was used to sit. Despite failing limbs and dizzied brain, I was not even then without a grim sense of humour at the absurdity of the whole affair.

As I took up one of the Dean's pens, having placed a sheet of the Dean's paper in readiness, something yielded slightly under my right foot. I hardly noticed the fact, but began to write:

'MY DEAREST LAURA,—What must you have thought of me? But it is through no fault of mine. I am shut up in the Dean's library, quite unable to find a way out. It sounds ridiculous, but'—

It did sound ridiculous, and I went off into a helpless fit of laughter, laying down the pen and holding my sides. Something again yielded under my foot. Involuntarily I pressed harder, glancing up as I did so. The board sank, and a crevice appeared in the wall just opposite the middle window, part of the bookcase bulging outward.

With a shout I sprang to my feet. My heart beat wildly, and for a moment I believed what I saw to be a delusion of the imagination. I rushed across—pulled—and the door opened easily.

'Free!' I gasped, and leaped outside, in terror lest the walls should close upon me of themselves, so low had I been brought by starvation. 'Free!' Then I reeled backwards against the baluster of the little winding staircase, at the top of which I stood.

Somebody was coming along the passage below. If I had not that moment let myself out, I should have been rescued a minute later. I could neither see nor hear clearly for the mist in my eyes and the buzzing in my brain.

'Tel—telegram—Laura!' I muttered. 'Couldn't help it. Couldn't get out, you know. I've been in there—ever since—starving'—

'You poor dear unfortunate John!' Laura's own voice exclaimed, with a burst of laughter. 'You dear, funny fellow! How *could* you do it?'

Evidently she had not heard my utterance, and I made an instant effort to pull myself together, braced by the merriment in her voice. 'I—er—yes—how kind of you to come!' I faltered, holding on to the baluster with a firm clutch, for the passage below seemed to be nearly over my head. 'I—er—very much occupied, you know—couldn't get away from the books—taking notes, you know—longer about it than—er—I expected.'

'Take care, child; he's nearly off,' a masculine tone remarked. Unfortunately, though Laura had not heard what I first said, her father *had* heard.

I am bound to confess that it was I who fainted on that occasion; not Laura. Laura is a vigorous modern young woman, addicted to bicycles, and never at a loss. The first words which reached my understanding as I emerged

from an unpleasant fog were, 'What a mercy he will have me to take care of him! These literary people *are* so helpless!'

Afterwards, of course, I heard more. The Dean, in his hurry, forgot to say anything to the servants about my being in the library, and they took it for granted that I had gone away first. That the Dean had not rung for any one to show me out was unnoticed in the general bustle; also, he had a way of often showing his friends to the front-door himself, after his genial fashion. Five or six of the domestics remained in the house; but they slept late next morning, as I had surmised, and then they went off for a jaunt of several hours' duration, leaving only one deaf old woman and a child in charge. This could hardly have been the intention of the mistress of the house, and I have reason to believe that some of them lost their places in consequence.

The old woman had passed her day in a part of the house where no sound from the library could reach her; and though the child confessed to having noticed certain queer sounds, she either thought nothing of them or was afraid to speak. Both old woman and child were in dire terror of the dog in the yard, and, though supposed to look after him, they were careful not to venture in that direction.

The Dean was a kind-hearted man. From London he took the trouble to send a telegram to Laura, whom he had known well in her childhood: 'I congratulate you; he is a capital fellow; left him in my library.'

For once the slow morning train was punctual to a minute in its arrival; and as a friend went to the station to meet me, my non-appearance could be early proclaimed. All thought of assembling in church at the hour fixed was given up, since I could not possibly be in time for the wedding; so that haunting scene of my imagination had no foundation in fact. Instead of anything half so tragical, friends appeared to have indulged in a good deal of fun at my expense, and Laura had to defend me from attacks all round touching

my unpunctuality, general unpracticalness, and supposed preference for Saxon antiquities over modern weddings. While all this was going on, and the bride whom I had pictured as forlornly weeping in white was really chatting gaily in green, another telegram came in, at first regarded as from me. It proved to be a second from the Dean:

'Going on boat. Uneasy as to J. S. Forgot to show him how to open library door. Peculiar arrangement. Hope all right.'

That was enough for Laura. My continued absence and the lack of any telegraphic explanation made clear that things were not 'all right.' She started with her father by the first train, and found me, as already told, when I had just succeeded in making my escape.

Why the Dean did not telegraph to his own servants has always been a puzzle to me; and how I failed to find sooner the trick of the door has always been a puzzle to everybody else. Laura tells the story against me to this day, ending regularly with a gay—'Just like him, poor dear fellow!'

Of course there is not a man of my acquaintance—letting alone the women—who doubts that he, in a similar position, would have managed to release himself in half-an-hour. Perhaps it is rather curious that I should not have thought of the neighbourhood of the writing-table, where the Dean usually sits; and that I should have lost so much time in tugging at a disused bell-rope in a corner, instead of finding the bell-handle at one side of that same table. But such is life! We are all subject to our little weaknesses, one way or another. And nothing is easier than Columbus's egg—when once the secret has been made known.

As for my history of the Saxons, which cost me so many hours of misery, the volume came out in due time, and was extremely well reviewed. How far the world has been the better for it I cannot say; neither is it needful to state precisely how many copies were sold. I have not yet made a fortune by means of that book.

A TRIP ON THE NEW CONGO RAILWAY.

By Rev. W. HOLMAN BENTLEY, of the Baptist Mission to the Congo.



THE Congo Railway is complete, so there is now direct and easy communication by rail between the ocean-going steamers arriving at the port of Matadi, on the Lower Congo River, and the fifty steamers plying on the 11,000 miles of waterway lying open from Stanley Pool, on the Great Upper River and its affluents. The river is navigable from its mouth to Matadi, a distance of 100 miles; beyond this point, for 200 miles, rapids and cataracts bar the

way, and those who wished to reach the Upper River had to tramp overland for twenty or thirty days, over hilly, stony roads, through woods and jungle-paths.

Commencing in 1886, the engineers had to face more than half their difficulties and expense in the first twenty miles. At the twenty-fourth mile a station was opened in 1893, but was little used. In 1896 the half-way point was reached, and in May the Tumba station was opened for traffic. Stores and transport agencies made their appear-

ance as if by magic. For two years that has been the point from which the natives carried the loads on their heads to Stanley Pool, instead of from the Lower River as formerly. Now all the line is complete, and the native transport no longer exists.

I took an early trip on the railway when it was only open as far as Tumba, before things were properly organised. The company were delightfully frank with their passengers in those days. 'You travel at your own risk entirely; we incur no responsibilities, and can only do our best to convey you to your destination. We do not want passengers or freight, for we have enough to carry for ourselves, in the rails, iron sleepers, bridge materials, &c., which choke our base. However, as you are to be our future freighters, we will oblige you, by conveying you and your goods; but you must put up with the inconveniences of our already congested traffic.'

My wife and our three-year-old girlie were to go home to England, and I had to see them off. The trains had been very irregular, and it was not safe to send them alone. The rains had been very severe; embankments had been washed away; there had been recently a big slip in one of the cuttings, and hundreds of men had been at work clearing the blocked line. Traffic had only been resumed three or four days; so I had to go as well. There were a hundred possibilities.

It is only one hundred and fourteen miles from Tumba to the port of Matadi; but the single ticket for my wife cost two hundred and thirty-three francs (£9, 6s. 4d.)—two francs per mile; my own, being a return ticket, was three hundred and fifty francs (£14); its number, 0001, showed that it was the first return ticket issued; it was available for four days.

The train was to start at half-past five in the morning, so we had to send the baggage overnight, and were advised to be very early, to get a seat, for there were many passengers, and only one carriage. The dawn had not broken when we passed the three factories of the trading companies to take our places. Across the line a cannibal Bangala from the Upper River stood as sentry, guarding the long transport store of the Congo government; externally the man had been made into a smart black soldier, in fez, blue tunic and knickers, and red girdle. Higher up the slope were the quarters of the State officers, built of mats or boards with grass roofs. Farther away to the left, beyond a swampy stream, one thousand native carriers were still sleeping in a long open shed, packed like sardines, their feet to their fires.

We started with excellent promptitude at half-past five, to the tu-tu of a horn, *à la mode belge*. It was a comfortable carriage, with pivoted, cane-seated chairs, glass windows, and sun-blinds—everything so far very convenient.

The *conducteur* was a native of Sierra Leone,

who had been educated in a mission school, while the engine-driver and stoker were blacks from Senegal, who had learned something of their profession on the railway there from Dakar to St Louis. They knew little of the properties of steam, save that it would burn you as it flies from the cocks; and as for mechanics—well, if you twist a certain cock a whistle results; a certain lever causes the starting of the machine, or, returning it, the stoppage; and so on. A leather thong round the waist is loaded with Moslem amulets done up in leather, black and shining. Fairly intelligent men, but quite illiterate. The trains, therefore, over a great part of the distance, were in the hands of Africans only—no white men in charge. The Congo State Government, as well as the Railway Company, make no distinction as to colour in their employés. If a black man is found equal in every way to a white man, he is paid and treated accordingly. Efficiency of work is the test. Only natives of Africa are permitted to travel second-class; they are allowed to sit on the trucks on the top of the passengers' luggage and general stores, amid a constant shower of hot cinders from the engine. For this they pay twenty-three francs (19s.) from Tumba to Matadi. Many make use of it. Some sixty or eighty soldiers were on our train, *en route* for Boma, the capital.

For a while we rattled briskly on, stopping two or three times to take water for the engines where the railway crossed a good stream. Two or three coast natives would be in charge of the pumping station, and would have to keep the 10,000-litre tank full. The track wound about among the low hills, which were torn by torrents in all directions. Ten miles to the north rose the cliffs and steep escarpment of the plateau of Bangou, 800 to 1000 feet above the broad railway valley. After a while we came to the steep climb of Kimpeze to cross a hill-range. We ran up a valley between two spurs, turning sharply round at the head of the valley, ever ascending, back out of the valley on one of the spurs, twisted round over the spur, up another valley, and back out again through a cutting in another spur, and round once more on the first spur, and so to the top. A wonderful piece of planning and climbing. Then a long, winding descent, and we reach an embankment and a fine iron bridge, ninety yards in one span. There we stop, for the bridge over the Kwilu River is not yet completed, and we must cross on the wooden trestles. The wooden temporary work had been several times washed away after heavy rains, for the river rose twenty feet sometimes. In another fortnight it was to be cleared away; meanwhile a light engine, which stood in a siding eighty yards behind us, was to push us across, and our heavier machine would return to Tumba with a train of rails, goods, and a truck of cattle for the railhead.

While the engine was being uncoupled I seized the opportunity to make a few notes, for such a

trip was worth describing. I inwardly wished that there would be some interesting 'incidents'; although, for the sake of my wife and child, I hoped that it would be a safe journey. I had scarcely written half-a-dozen lines when something happened. I was conscious of a crash and shock; my pivoted chair whirled round with me; the roof-lamp flew against the glass door of the carriage beside me, and shivered itself and the glass; a shower of paraffin, a violent jerk backwards, and a tangled heap of passengers in the middle of the car! Some one said that the shunting-engine had dashed into us. Scarcely had the word been uttered than we saw the same engine dashing at us again! Crash! the chairs whirl, a back jerk afterwards, and the passengers once more in a heap on the floor, some cut. A bolt for the door ensued, and some struggled through the narrow windows. The injured were examined. The wild engine came steadily up to the train this time, as if nothing had happened. The engine-driver was soundly abused by the local authority, and fined; but it was hard to ascertain what had happened, except that the moment the steam was turned on, the engine had rushed at full speed at our train, each time from seventy or eighty yards. Once more we entered our carriage, and were pushed over the fine bridge, and started on again. My ardour for 'incidents' was much cooled.

A run of thirty miles over hilly country, then we pulled up at the half-way station Songololo. 'All alight, please! The train goes no farther to-day; these two tents are at the disposition of passengers.' We had not been warned of this at Tumba, but had started hoping to reach Matadi that day. I believe that a notice was posted at Tumba later on in the day, that for the next fortnight trains would take two days over the journey. Two large single-roofed tents in the fierce sun were thus offered. As my wife and child were with me, a wooden shanty was found for us. Every one was kind, and ready to help. There were no shops where food could be obtained; only water could be supplied. We might buy bread from a bakery forty miles away, when a service train came in in the evening. Fortunately, we had a midday meal with us, and I had brought something for the return journey. Songololo is a fairly flat spot in a wilderness, thinly inhabited, and well stocked with game; elephants, buffaloes, and antelopes are to be found. About two hundred black workmen had their huts there—platelayers, ballasters, and engine-cleaners. There were also shanties for the white engineers. I asked one of the natives what we were really stopping for. 'No coal; not a pound of it on the station. Three trains are in the sidings unable to go on.' They were only able to supply half rations of coal, until a new supply came from Europe in a fortnight's time. That morning they were clean out of it, but a coal train was due in the evening.

A blanket on a board floor makes a hard bed,

so we were prepared to get up at five o'clock next morning, to be ready to start half-an-hour later. We did not get away, though, until half-past eight. All desire for further 'incidents' had vanished.

It was an interesting ride, for great engineering skill was needed to make a railway in the mountainous country toward the port. Sometimes we ran into masses of hills, through which no way seemed possible; but a sudden twist would reveal a torrent in a gorge between two lofty hills, and we wound round beside it on a terrace in the steep, wooded banks. We enjoyed a good deal of this sort of travel, through beautiful forest and mountain scenery, now following a torrent in its ravine, rapidly descending with it, until it turned aside into a larger stream; crossing this, ascending it, then a sharp corner, and the ascent of one of its feeders—another torrent—in a densely-wooded ravine, until we come to a cutting in a *col* (high water-parting), and down the other side into another system of torrents. The whole of this part of the road is a marvel of courage and skill, and very thorough work—no scamping anywhere. No one would have thought a railway possible in such a country.

At length we pulled up in a wooded gorge at a little station. There was no population to need a station there, but there was a good stream, and the station was required as a point on the single-track railway at which trains could pass. We were telephoned to wait here an hour, for the director-in-chief was coming up, and his train had the block-staff. There was time for us to bathe in the stream, the Ndzwizi. Quartz was everywhere about, but amid the micaceous sand and quartz pebbles no gold has been found, although such a likely place. How very convenient to stop and enjoy a bathe in the middle of such a ride on a hot day! So much better than the feverish rush of railway travel at home! One day the engine-driver lost his hat on the way; but he stopped the train and ran back for it a quarter of a mile. Why not? The bathe over, we strolled round. A native at the station had some bananas for sale, but had no shame in asking a franc for each single banana!—so exorbitant have become the prices along the line. Demand creates no supply out here; it only drives up the price of things. When Tumba railway station was opened a new route of transport became necessary. When the first caravans arrived in a district, even where food was plentiful, exorbitant prices were demanded and paid. The women who made the food being able to get the barter, cloth, &c. they wanted with one-tenth of the labour, one-tenth of the food previously made was supplied. Prices rose higher, and the unfortunate carriers had to pay these fearful prices or go hungry. Then, when ordinary people in the towns wanted to buy food—orphans, unmarried young men, old people—the women would not sell to them; they kept the food for the carriers; so all suffered, and because they could not pay

such prices, the manioc was allowed to rot in the ground. This has occurred again and again, and many have died in consequence. Wealth is a great curse to these people—hunger results; while poverty means an abundance of food. So this rascal would have a franc for each single banana on his bunch or not sell at all, and this in a land of bananas! I had to go without. I would not pay such a price. Fowls were five to seven francs each, and small into the bargain. Such is the overreaching avarice of the African.

The director came, and we started; but after eight miles there was another long wait. The first store was here, so refreshments were found, and tins of delicious sterilised milk (not condensed). Thence only twenty-four miles lay before us. It was three o'clock in the afternoon, so we were sure of getting to Matadi all right.

We came into the station of La Mia, at the foot of the last great climb over the Mpalabala Mountain, the greatest engineering feat of all. Over this part of the railway we had a white engine-driver; nevertheless our engine left the rails at the crows'-feet of the station points, and all its eight wheels were buried in the ballast in a most awkward place. Jacks and all needed tools are carried by each engine, for such things often happened then. It was soon evident that the engine could not be on the rails until the small hours of the morning. There was a three-roomed shanty on the side of the hill. A black clerk from Sierra Leone was in charge of the station; an Italian engineer had one room. He offered us everything he had in his pantry; begged us to take anything we liked: most kind he was. We took some macaroni to eke out our supplies, for now we had been two days *en route*. We spent our second night in the shanty.

At three o'clock in the morning they succeeded in getting the engine on the rails; but it was five o'clock before we were all on board and started again. We wound our way up the long climb of 360 feet, and descended with great care the 830 feet on the other side. This part of the line is a wonderful piece of construction. A terrace had been cut in the steep side of every ravine that scored the side of the mountain, in and out again, then round a spur into another ravine, and over a light cobweb (iron) of a bridge, eighty feet above the torrent. The lines were laid in a sharp curve on the bridge, so that the train could swing out of the ravine on the other side. The plan of the railway in these ravines is like a U, the curve of which is on the bridge. The bridge is three times the width necessary for the narrow gauge (thirty-two inches), so that there is room for the curve.

At length the Mpozo River was crossed, roaring and tumbling on its way down to the Congo; then the route lay on terraces along the precipitous slopes of the Mpozo gorge. The carriages overhang the rails, and the way is so narrow that from the

windows of the carriage, in some places, you can only see the Mpozo foaming on the rocks 100 to 150 feet below you; while the track winds round such fearfully sharp curves that the speed has to be reduced almost to a walking-pace.

In the early days there was a terrible accident in that Mpozo ravine. A truck of dynamite, with some forty workmen on it, was standing in a siding; an engine came to pick them up; the driver ran his engine too heavily on them; the dynamite exploded, and blew train, line, trucks, and everything and every one to smithereens and down the precipice. Higher up the hill, engines have more than once derailed and crashed down into the ravines. Last time that happened, the stoker was in the act of adding to the fuel in the furnace, and the jerk threw him into the firebox of the engine as it tumbled. Now the way is well ballasted and settled in this part.

As we rounded the mouth of the Mpozo a great crocodile lay, with his mouth wide agape, on the sandbank below us, unmoved by railway whistles and rattling trains; he was used to them. We reached Matadi at half-past six in the morning. On my arrival I called attention to the fact that the time for my return ticket had almost expired, and an extension was granted.

The town of Matadi ('rocks') is a rocky place, built on the steep banks of the river; the houses, factories, and stores are perched about wherever a terrace can be made. The river there is rather less than a mile wide, in a gorge a thousand feet deep. The repairing shops of the railway are there, stores and station ground, and a pier, so that the ocean steamers can discharge into the trucks.

My return journey had also its 'incidents,' for as we were climbing a steep bit with many curves, in a cutting twelve feet deep, we suddenly pulled up. The engine was off the rails! I gathered firewood, and grass for my bed, and prepared for another night out. After an hour the engine was on the rails. We started, backed a yard or two, and then forward, and off the rails again at the same place. It was five o'clock, and not until half-past seven did we get right again. Once more a start, and off the rails again, two feet farther on; so once more the jacks were placed, but it was half-past eleven before we started again. This time we did succeed in passing the bad place, and ran along fairly well, but we had a heavy train.

Passing the Lufu River, we commenced the steep ascent beyond, but half-way up came to a standstill. The engine was not strong enough. We backed a little, and tried again and again, but it was no use; so we dropped down the hill again, and were left standing on the bridge, at two o'clock in the morning, in the dark, while the engine took up the fore-part of the train. Happily nothing came up behind us, although we had passed no telephone station for the last eleven hours. There was a station a mile beyond, but they would not trust that engine down again;

they sent another, which, with a down passenger train, had been waiting for us to pass ever since eleven o'clock the previous morning. When we reached the station the down passenger train passed on, and we continued our way to Songo-lolo, where we stayed five hours. Thence our train consisted of the first-class carriage, a cattle-truck, and two trucks heavily loaded with rails, and on these a number of bags of the State mail.

After passing the Kwilu, the engine that took us on was quite unequal to its task. We would run half-way up a hill, fail, and back down to the bottom; wait a quarter of an hour to get up steam, and try again. Sometimes the attempt would not be made without a stoppage to get up the pressure. So we progressed. We did reach a siding; but the driver was in a dilemma. The cattle could not be left, for they needed water and food; the trucks must go on because of the mails, and the passenger carriage would be wanted at once; so he went on. It took us six and a half hours to do that last twenty-four miles into Tumba.

These difficulties and troubles of the first days

are now over; the service is improved, and works well. I came over the same ground last October in thirteen hours in comfort and safety, and without an 'incident.' The railway has been completed to Dolo, Stanley Pool, and round to Leopoldville, a distance in all of 250 miles. In the first days of June the first 'personally conducted' party of tourists started, under the auspices of Messrs Thomas Cook & Sons, to be present at the official opening of the railway. So the great victory over Nature has been won, and the long reaches of the Upper Congo have been connected with the world.

A fast service of steamers is to run between Antwerp and the Congo in eighteen days; the railway is to do the whole distance from Matadi to Stanley Pool in twenty hours. A fast steamer for the Upper Congo is to be sent out in pieces, to be reconstructed at Stanley Pool; she is to do the journey thence to Stanley Falls—1000 miles—in eleven days; so that it will be possible to go from Antwerp to Stanley Falls, in the very centre of Africa, in thirty-one days—a triumph of Belgian energy and perseverance.

THE MONTH: SCIENCE AND ARTS.

COMMUNICATION IN TRAINS.



R F. HOLLINS, telegraph engineer and superintendent of the Great Eastern Railway, deserves the thanks of the community for having devised a system of electrical communication between passenger and guard which

has met with the approval of the Board of Trade, and which is given freely to the world, for it is not protected by patent. In a central position in each compartment of the railway carriage is placed a lever switch working right or left against fixed stops, with a notice above it in bold print: 'To communicate with the guard in case of urgent need, move handle against either stop. Penalty for improper use, £5.' Such movement rings bells on the engine and in the guard's van, while at the same time a red disc is projected from either side of the carriage from which the alarm has come. The lever handle remains fixed against the stop towards which it has been urged until released by the guard with a special form of key, and the bells continue to ring until such release has been effected. The circuit can also be used for exchanging signals by a prearranged code between guard and engine-driver at all times. But perhaps the most valuable feature of the invention is found in the circumstance that the necessary electrical connections between one carriage and another is carried through the same india-rubber tube which operates the brake—that is to say, the operation of joining up the brake-tube between carriage and carriage also establishes

electrical communication throughout the train between passenger, guard, and engine-driver. Such an apparatus has long been needed to replace the wholly inadequate contrivances at present in use on our railways, which are generally reported to have 'failed to act' when occasion for their use has arisen.

THE SALMON AND ITS FOOD.

It has long been a question among naturalists and anglers whether or not salmon and its near allies feed in fresh water, for it is a fact that food is rarely discovered in the stomach of a salmon, sea-trout, or sewen which has been in fresh water for any length of time. The subject has been commented upon from the time of Izaak Walton, and has formed the theme of many a discussion among fresh-water anglers. With a view to settle this interesting question, the Fishery Board of Scotland have made a series of investigations, and as a result have issued a report on the life-history of the salmon. This report is edited by Dr D. Noel Paton, who has been assisted in his work by many experts. The general conclusions arrived at are: (1) That there is no reason why salmon should feed during their stay in fresh water, as their bodies contain sufficient nourishment for all their requirements. (2) During their stay in fresh water the material accumulated in the muscles steadily diminishes, and there is no indication of the loss being made good by food. (3) There is every indication that during this period the organs of digestion are functionless. The case of

the salmon, it is pointed out, is not exceptional in this power of abstaining from food for a long period—the male fur-seal, after coming to land, being able to live for more than three months without food. It would seem that this characteristic of the *salmonide* is a wise provision of Nature, for in some of the small rivers to which salmon resort for spawning purposes there could not be found sufficient nourishment to meet their wants if they retained the enormous appetites which they have while at sea. Anglers at least are glad to know that, although salmon are not regular feeders in fresh water, they are not averse to an occasional snap at a fly.

A NEW TORPEDO-NET.

As a protection against the action of torpedoes, our warships were provided with wire-netting shields, or crinolines, which can be extended by spars, so as to form a wall around the vessel's sides. Upon which some ingenious inventor gave the travelling fish-shaped destroyer a cutting implement at its head which could penetrate the wire screen. A new form of crinoline has now been introduced which possesses a mesh of such construction that it cannot be pierced. But the invention probably comes too late; for if any lesson is to be learned from recent events, it is that the torpedo in naval warfare is of such secondary importance that it may be almost neglected altogether. We have learned lately that fighting ships armed with modern guns need not get to close quarters to work terrible destruction upon one another. A couple of miles separating the attacking vessel and that with which she is engaged is regarded as a near range; and no torpedo is effective at a quarter that distance. Quick-firing guns and accurate marksmanship are the far more important items to attend to, and American perfection in both these respects has recently determined the issue in the present war.

A MOUSE MOTOR.

It has become the fashion among enterprising traders to attract attention to their shop windows by the exhibition of some moving object, generally actuated by clockwork. A distinctly novel idea in this direction is that recently adopted by certain American bicycle dealers, who have succeeded admirably in not only attracting attention to their wares, but in showing at the same time the perfection of their workmanship. They show, in brief, how the wheel of a cycle may be driven by mouse-power. The bicycle is either attached to a frame or hung to the ceiling—so that the front wheel is clear of the ground and can run easily. Just above the top of this wheel and fixed to the steering head of the machine is a mouse-cage with no bottom, but so close to the tyre that the animal within has no room to escape. The weight of the mouse is sufficient to give the wheel an initial movement, and the poor

little creature trying to run to a refuge provided for it in the cage keeps up the motion in treadmill fashion. Usually there are two mice in each cage, and one or the other is generally doing work on the wheel.

POLAR EXPLORATION.

The *Fram*, which did such good service in Nansen's expedition, has once more started northwards from Christiania under the capable leadership of Captain Otto Sverdrup. The chief objects of this second Norwegian expedition is to discover the northern limits of Greenland, and to study the formation and trace the origin of the palæocrystic ice, while many problems of minor importance will be left for solution to the five scientific men who constitute part of the staff of the ship. The *Fram* has been much altered and improved in various ways, and the expedition carries a very complete outfit of necessary apparatus in the way of sledges, canoes, &c., with a large number of dogs. Antarctic exploration does not seem just now to be faring quite so well as it might. Failing to obtain the expected support for the enterprise from the British Government, the Council of the Royal Geographical Society are endeavouring to obtain the necessary funds to start a Southern expedition under their own auspices, and they are inviting subscriptions towards that end. At least fifty thousand pounds will be required to defray the expenses, and the society itself heads the list with one-tenth of that amount.

TESTING COAL BY THE X-RAYS.

M. Couriot has demonstrated in a note communicated to the Paris Academy that the Röntgen rays can be profitably employed in the examination of coal, peat, lignite, coke, &c. Pure carbon, whether it be in the form of coal or diamond, is perfectly transparent to these rays, while the flinty matter which goes to make up the slag and clinker-forming portions of the fuel is opaque. If, therefore, a sample of coal be examined by means of the rays and a fluorescent screen, the amount of carbon as compared to less valuable constituents can be very readily determined. It is a curious characteristic of these rays that most of the bodies which are transparent to the eye—with the exception of a few, including the diamond and mica—are quite opaque when examined by this method; while coal, charcoal, jet, &c. are perfectly transparent, as noted by M. Couriot.

THE POTTER'S WHEEL.

One of the oldest mechanical contrivances known is the potter's wheel, the products of which, dating many centuries before our era, are dug up in all parts of the world. It is still in common use; but the recent manufacture by a totally different method of a very common piece of pottery—namely, the flower-

pot—suggests the reflection that more valuable specimens of earthenware may possibly be turned out by the new process. A machine by which flower-pots can be produced at the rate of sixteen per minute, and at half the cost of the older process, the invention of Mr William West, a well-known orchid-grower, was recently exhibited at Walthamstow, Essex—in which district there happens to be many pottery-works, where perhaps the introduction will not at first be regarded with the favour which it deserves. The new machine presses the clay into a mould, and turns out pots smooth in the interior, less liable to fracture than those of ordinary make, and so dry that they can be placed in the kiln almost immediately.

A NEW BULLET.

It is not altogether pleasant reading for a man of humane disposition to learn that the War Office has adopted a new bullet, on the ground that the ordinary Lee-Metford missile is not deadly enough. Although the Lee-Metford has a terribly long range, it does not disable an enemy as effectively as is thought desirable, men being known to have gone on fighting after half-a-dozen such bullets have gone through their bodies. Such a bullet, too, has been known to pass through two or three men consecutively, penetration being its characteristic rather than shock. The new bullet has the same diameter (.303), length, and weight as the Lee-Metford, with a nickel case filled only partly with lead, the conical end being left empty. Its action on entering the body is to open out and lodge there; and it is spoken of as the 'man-killing bullet' in contradistinction to the piece of lead which it supersedes, which is known as the 'man-penetrating bullet.' This new and ghastly messenger of death is being manufactured at Woolwich at the rate of two million rounds of ball cartridge per week, and it will be used for the first time in the Soudan expedition.

THE EVOLUTION OF SMALL ARMS.

An interesting paper with the above title was lately read at the Royal United Service Institution by Lieutenant-colonel Lockyer, chief inspector of small arms. The lecturer showed how the old muzzle-loading Enfield was in 1866 superseded by the breech-loading Snider, a mere stop-gap until something better could be introduced. This happened in 1871, when the Martini-Henry weapon—in his opinion the best military breech-loader ever made—was adopted. Then came the cry for magazine rifles; and in order to keep pace with other European nations the Lee-Metford was adopted in our service, certain alterations being subsequently made in the arm, such as the enlargement of the magazine to hold ten instead of eight cartridges and the substitution of cordite for black gunpowder. A great advance was made when one description of cartridge was adopted for

all rifles, carbines, and machine-guns. The lecturer said that for a long time it had been his desire to see one universal pattern of firearm in the hands of all services, and the weapon which he favoured was the carbine. It weighed two pounds less than the rifle; and although it did not make such absolutely accurate target practice as the rifle, it was far more handy in the field, where bull's-eye shooting was not required. With regard to machine-guns, he believed that their evolution was still in progress. The Maxim, although a good weapon, could scarcely be called an ideal automatic gun. What was wanted was one which could go on firing steadily and certainly, it being a minor consideration whether it projected three hundred or six hundred shots per minute. Lord Charles Beresford, who occupied the chair on the occasion of the lecture, expressed the opinion that if the carbine were the better weapon it ought to be adopted, but that it would not be advisable to make such a sweeping change without practical test on a field of action.

LUCIFER-MATCHES.

It is to be hoped that the agitation which has recently been made with reference to the terrible disease common in match-factories, and known among the poor workers as 'phossy jaw,' will lead to the abandonment of the employment of yellow phosphorus in the manufacture of matches. It would seem that the settlement of the matter is really in the hands of the public, for if all people would insist on using safety-matches only—we mean those that will only strike on the box in which they are contained—the use of yellow phosphorus would cease. This chemical gives off a poisonous vapour which, when inhaled by the match-workers, leads to a most fearful disease, which principally attacks the jawbone. As long ago as the year 1848 it was discovered that when phosphorus was exposed to heat under certain conditions it assumed a new form, its yellow colour changing to red, no poisonous vapour rising from it, while at the same time it could no longer be ignited by simple rubbing. Excellent matches were at once made, the chemical being mixed with sulphite and antimony, and painted on the box, while the matches themselves consisted of a composition innocent of phosphorus, but which would ignite when brought into contact with it. The patent for these safety-matches has long ago run out, and any one is free to make them. Yet to save themselves a little trouble a large section of the public prefers matches of the older pattern, and a demand is therefore created for an article the manufacture of which is fraught with evil to the workers. The man who invents a match made with red phosphorus, which will strike on any rough surface, will not only reap a large fortune, but will be a public benefactor. It is satisfactory to note that an inquiry into the subject of making lucifer-matches

with yellow phosphorus has been ordered by the Home Secretary.

POULTRY-FARMING.

A report has recently been issued by the agricultural department of the Lancashire County Council, which gives the results of an elaborate experiment carried out for the Council by Mr Thomas Carr, who maintained that it was possible to keep fowls confined to a grass run, or at liberty about a farm-yard, in a healthy condition, at the rate of 200 to one acre, and to show a profit of not less than five shillings per fowl from egg production per annum. A plot of land at Preston was set aside for the experiment, on which was built, under Mr Carr's direction, a roosting-house, a laying-house, and two shelters. A special feeding-trough was used, from which the fowls—thirty in number—would scratch the contents, while they could not spoil it. Sufficient food for the day—consisting of 11 parts Indian meal, 11 parts cockle-seed, and 2 parts bone-dust, and sometimes corn screenings and mixed peas—was placed in the trough each morning. The experiment continued for a year, careful accounts being kept of the cost of food, &c.; the number of eggs laid during the period being 3730, fetching a shilling per dozen. The balance-sheet shows a profit of nearly nine pounds; but it is only fair to note that there is nothing allowed for labour, and experience has taught us that even on a small scale fowls cannot be economically kept without a considerable amount of attention. But the experiment plainly proves that cottagers and others who have the opportunity of giving poultry space and attention can make them pay, provided that they are in reach of a market for the eggs, to say nothing of the chickens, for which there is always a demand.

THE FRESCOES AT WESTMINSTER PALACE.

The wall paintings in the Houses of Parliament have, during the last two years, been undergoing a cleansing and restorative process, under the able direction of Professor Church, and a parliamentary paper has recently been published showing the progress of the work. Here mention is made of an apparatus of novel design which the Professor has devised, and which he hopes will prove an effective aid in his work. This contrivance produces a powerful air-blast charged with bread crumbs, which can thus be projected upon the surface of the paintings. The apparatus has been returned to the makers for certain modifications, and the Professor hopes to employ it advantageously when the required alterations are completed.

SEA-SICKNESS.

In the notes on sea-sickness which Dr Hugh Taylor contributes to the *Lancet* there is not much comfort to be derived by the sufferer from that distressing ailment. He tells us—speaking from a five years' experience in the North Atlantic

passenger service—that the doctor has no means, either by drugs or otherwise, of controlling the sickness; something which may act as a palliative to a patient during one voyage being useless the next. He has never seen any of the quack remedies do the slightest good; and although he has seen relief afforded by certain remedies which he names, his remarks go to show that regulation of the general health is, after all, the best safeguard from the more distressing forms of *mal de mer*. A farewell dinner or jollification is, he tells us, the worst possible preparation for a sea voyage; a far more sensible, but less festive, prescription being a blue pill and seidlitz powder.

'THE WHITE HEATHER.'

I BRIBED you with a promise,
One idle August day,
To guide you where the heather rare
Concealed its charmed white spray;
And as we went together
I dreamed, 'twixt hope and fear,
The fairy flower would give me power
To tell you all, my dear.

Though love had made me silent,
Mine eyes could call you fair.
You hummed a song the way along
To show you did not care.
The honey-hearted heather
Sprang ripely far and near;
And many a flower was red that hour,
But none was white, my dear.

Some blooms were rudely ruddy,
And some were palely pink,
And some so light—nay, almost white—
We had to stop to think.
And once an alien daisy
Made you exclaim, 'Tis here!'—
Ah! many an hour we sought the flower
And found it not, my dear.

I doubt my search turned careless.
Perhaps the treasure grew
Snow-pure and sweet before my feet
Those times I looked at you.
Yet, is Romance in ruins
Because, as eve drew near,
I found the power, without the flower,
To tell you all, my dear?

J. J. BELL.

* * TO CONTRIBUTORS.

- 1st. All communications should be addressed 'To the Editor, 339 High Street, Edinburgh.'
- 2d. For its return in case of ineligibility, postage-stamps should accompany every manuscript.
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